DOCUMENT RESUME

ED 423 733 HE 031 469

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TITLE	Faculty Rewards and Curriculum Reform (and Vice-Versa).
PUB DATE	1998-04-00
NOTE	23p.; Paper presented at the Annual Meeting of the American Educational Research Association (San Diego, CA, April 13-17, 1998).
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Administrators; Case Studies; *College Faculty; *College Instruction; *Curriculum Development; Educational Attitudes; *Educational Improvement; *Engineering Education; Higher Education; Partnerships in Education; Research Universities; *Rewards; Undergraduate Study
IDENTIFIERS	National Science Foundation

ABSTRACT

This case study examined the effects of the BUILD Coalition program which provided incentives to faculty who developed innovative approaches to engineering education. The program was one of eight Engineering Education Coalitions sponsored by the National Science Foundation to seek ways to gain greater legitimacy for teaching within the faculty reward system. Semistructured interviews were conducted with 55 faculty at four large research-intensive universities in the Coalition. It was found that while some faculty and administrators appreciated the program's additional funding and visibility for undergraduate education, most described engineering faculty as indifferent to these incentives, with teaching still seen as irrelevant compared to the faculty's perceived core responsibilities of research and graduate education. Most interviewees rejected the proposition that the incentives were a meaningful force for change in faculty reward systems. Two themes emerged from the interviews: the first was that the program's weakness was attributed not so much to its focus on undergraduate education but to its marginality as a change agent; the other was the belief that while instructional reform per se was unlikely to alter the faculty reward system, reforming practices that promoted student learning might influence the allocation of faculty rewards in ways that could further strengthen undergraduate teaching. (Contains 18 references.) (CH)

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Faculty Rewards and Curriculum Reform (and Vice-Versa)

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Presentation to the Annual Meeting

American Educational Research Association

April 1998

HE 031 469

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Abstract

Recent concerns about undergraduate education have prompted efforts to place greater emphasis on the faculty's teaching role. This paper reports findings from a case study of one such venture. By offering incentives to faculty members who develop innovative approaches to engineering education, the BUILD Coalition seeks to gain greater legitimacy for instructional reform within the faculty reward structure and thereby institutionalize the changes it has set in motion. Interviews with 55 participants indicate that progress toward these goals has been limited by the perceived marginality of some projects and that, before attempting to manipulate the reward system, the coalition should first demonstrate the educational value of its programs.

Faculty Rewards and Instructional Reform: A Case Study

In response to wide-ranging criticisms of their educational quality and institutional responsiveness, a number of colleges and universities are redefining their expectations for faculty role performance. Heeding the concern of Boyer (1990) and others that a disproportionate emphasis on research has diverted faculty members from undergraduate instruction, some institutions have established an alternative reward structure, in which teaching and advising have approximately the same value in determining tenure, promotion and merit pay raises as do research and publication (Edgerton, 1993).

The belief that the conventional system of faculty rewards inhibits instructional change has also led to external efforts to stimulate the reform process. In a variety of academic settings, foundations and government agencies now offer incentives for faculty members to work toward the improvement of undergraduate education. One such project is the BUILD Coalition (a pseudonym), one of the eight Engineering Education Coalitions sponsored by the National Science Foundation (NSF). The coalition's primary mission is to develop a new engineering curriculum at each of its member institutions. It seeks to achieve this end by awarding competitive grants to faculty in engineering and related disciplines who develop innovative approaches to curriculum content and delivery. In addition, it enlists the support of campus officials in rewarding these activities through favorable personnel actions, thereby encouraging other faculty to adopt forward-looking teaching methods.

The purpose of this paper is to present findings from a case study of the BUILD Coalition. More precisely, it examines the coalition's attempt to gain greater legitimacy for instructional reform within the faculty reward structure of its four largest and most research-intensive institutions. In identifying some of the factors that have promoted or impeded the acceptance of the BUILD agenda on these campuses, we hope also to gain broader insights into the linkage that may exist between the allocation of extrinsic rewards to the faculty and the improvement of undergraduate education.

The presentation proceeds in three stages. First, it sets the context for the study by discussing the circumstances that have given rise to instructional reform movements in general and the BUILD Coalition in particular. The second section describes the methods of data collection and analysis. Finally, the case study results are considered in light of the current demand for restructuring the academic reward system of American universities.

Roles and Reforms

Although studies consistently find that teaching and research are not fundamentally incompatible (for a recent review, see Hattie and Marsh, 1996), tensions between these two dimensions of the faculty role have existed since the rise of the modern research university in the late nineteenth century. Thus, historians have concluded that

> the most pronounced effect of the (university's) increasing emphasis upon specialized research was a tendency among scientifically minded professors to ignore the undergraduate college and to place a low value upon their function as teachers...If investigation was the principal aim of the university, then giving one's attention to immature and frequently mediocre students could easily seem an irritating irrelevance (Veysey, 1965, pp. 143-144).

In engineering, faculty role strains were compounded by a split between what Geiger (1994, p. 283) has called the profession's "shop" and "school" cultures. Originally focused on product engineering and other practical applications, undergraduate education gradually shifted to a more purely scientific orientation. Largely in an attempt to shore up the field's academic legitimacy, the post-World War II engineering curriculum came to be frontloaded with mathematics, physics, and chemistry requirements, while engineering courses were delayed until the final two years of study. The results were a high attrition rate among freshman and sophomores and, by the 1980s, an increasing perception by employers that engineering graduates lacked some of the skills needed to advance in modern corporate environments (Augustine, 1996).

The NSF coalitions emerged as one response to such concerns. Although each coalition pursues its own agenda, there is a common vision of the attributes that engineering graduates should possess. As stated by one NSF official, these include

> disciplinary depth plus integrative abilities and experience in designing and manufacturing 'products.' They will have to know to synthesize and integrate knowledge, handle ambiguity, and work in teams to develop the best solutions. They will also need to understand how to factor societal, environmental, and market considerations into their solutions (Preston, 1993, p. 27).

The BUILD Coalition

BUILD was established in the early 1990s as a coalition of engineering colleges at four Research I universities. (Three smaller, teaching-oriented institutions were added later, as was a Research II university.) Its model curriculum is conceptualized not as a sequence of courses but as a statement of principles, similar to the NSF goals mentioned in the preceding paragraph. In conjunction with its emphasis on curriculum reform, BUILD also seeks to increase retention rates, especially among women and students from underrepresented minority groups.

To meet these goals, BUILD solicits project proposals from faculty and staff. With an annual budget of $3 million, and mandatory dollar-for-dollar matching from the member institutions, the coalition has funded upward of 100 projects, including multidisciplinary classes, distance and computer-assisted learning, summer transition programs, freshman and sophomore engineering laboratories, and engineering courses conducted on the basis of corporate management strategies. Project budgets vary widely, but often cover summer

stipends, release time, equipment, graduate student support, and other expenses traditionally included in research grants. Grantees are also encouraged to disseminate their findings through publications and conference presentations.

The major uncertainty facing BUILD is whether the changes it has set in motion will be institutionalized. Because the NSF coalitions are intended to be temporary organizations (each will be funded for no more than ten years), BUILD must count on its member institutions to absorb successful projects into their own programs and budgets. One mechanism for institutionalization is the Deans' Council, which functions as the coalition's governing board and whose members have formally committed their institutions to the coalition's aims. It is understood, however, that the fate of the reform program ultimately rests with the faculty, relatively few of whom--only about 20%--have been involved with BUILD. Accordingly, the coalition's plan calls for deans and sympathetic department heads to give faculty members' BUILD activities due recognition in tenure, promotion and merit pay deliberations. Once the number of such cases attains critical mass, and becomes widely known, other individuals can be expected to undertake their own instructional improvement efforts and to demand to be rewarded for so doing. In effect, a new set of expectations for faculty role performance will have been created.

That, at least, is the scenario toward which BUILD would like to be moving. Whether it is actually doing so is the subject of the rest of this paper.

Method

The data were collected in conjunction with a qualitative evaluation conducted during the third and fourth years of BUILD's existence. Most of the information reported here was originally intended to provide feedback to coalition leaders about the extent of program delivery, to discover obstacles to systemic change in the undergraduate curriculum, and to identify factors that might be useful in attracting other faculty participants.

Although each of the eight BUILD sites was included in the evaluation, the objectives of this case study required that the focus be limited to institutions whose faculty reward systems placed an especially heavy emphasis on research. Consequently, the sites chosen were those four that met the current Carnegie criteria (doctorates awarded and research support received) for classification as Research I universities (Carnegie Foundation for the Advancement of Teaching, 1994).

Source

The major information-gathering techniques were semistructured interviews with as many coalition participants as were available at the time of our site visits. In addition, hundreds of coalition documents were analyzed, including project proposals, annual reports and course syllabi. The authors also participated in coalition staff meetings,

workshops, annual conferences, and visits from NSF program officers and external reviewers.

The interviewees represented a range of academic roles, including all ranks of the tenure-track faculty, as well as adjunct and visiting faculty, research associates, and coalition and institutional administrators. Their academic disciplines encompassed the major branches of engineering, as well as the natural sciences, humanities, social sciences, and professional fields of study. The common denominator is that at the time of the study, each of the participants had had at least one year of experience with the coalition. In short, they had had ample opportunity to reflect on the issues at hand.

A total of 55 interviews were conducted. Most were individual interviews (though some project teams were interviewed jointly) and lasted 30 to 45 minutes. The content of these sessions varied with the role of the informants. In the case of current grant recipients, questions dealt with the project's origins and status, and the professional costs and benefits of being associated with the coalition. (Staff members of past projects also gave their reasons for leaving, which typically were either that the project had achieved its objectives or that its funding had been terminated.) This usually led to a more open-ended discussion of the faculty reward structure and its responsiveness to the coalition's agenda. For the campus and coalition administrators whom we interviewed, the questions centered on the local reward system, the history of BUILD on each campus, and the overall reaction of the faculty.

In view of our role as internal evaluators, steps were taken to reduce the tendency toward social desirability bias or acquiescence on the part of interviewees. These

safeguards included collection of information from multiple sources for each project, the inclusion in the interview sample of faculty members who no longer were participating in the coalition, and guarantees of confidentiality to all interviewees.

Analysis

The format used in this research was the embedded single-case study, in which multiple units of analysis are examined within the context of one encompassing organization (Yin, 1994). In the present instance, the analysis was conducted at three levels: The coalition itself, the four participating colleges of engineering, and the many individual projects that comprised the coalition's major vehicles for achieving its goals.

As is customary in qualitative research, the data were analyzed inductively, with an eye towards their usefulness for theory-building. The procedure used here was to group individual instances into a series of increasingly refined categories and then to use the emergent categories as a basis for generalizations (Seidman, 1991). As will be discussed subsequently, the theoretical frame of reference centered on the diffusion of innovations (Rogers, 1994).

Results

The first set of findings describes the overall reaction to BUILD on the four participating campuses. From there, we will turn to the coalition's perceived impact on faculty rewards.

Engineering Education and "Real Engineering"

In the course of describing faculty roles at their institutions, several informants referred to a distinction commonly made by the engineering professoriate: Any teaching, planning, advising, curriculum development, or assessment involving undergraduate instruction is classified under the rubric of engineering education, while research on substantive topics within the engineering disciplines is viewed, as one person noted ironically, as "real engineering."

That BUILD was perceived as a venture in engineering education worked both to its advantage and to its detriment. On the positive side, the legislatures in two of the states where the coalition is located had recently enacted strong provisions to encourage their universities to upgrade undergraduate education. In one case, faculty in any discipline who were identified as outstanding teachers had $5000 added annually to their base pay. According to one department head whose faculty had received six such awards, this program caused "a recognizable change in faculty attitudes toward instructional innovation." BUILD also benefited from the close relations that the participating colleges of engineering had established with corporate and industrial organizations. Faced with employers' demands that graduates be better prepared for the workplace, one engineering dean found that the money and visibility provided by the coalition provided "a mechanism to do what we wanted to do."

More generally, however, the engineering faculty was described by participants as largely indifferent to BUILD, while undergraduate instruction continued to be perceived

as irrelevant to the faculty's core responsibilities of research and graduate education. One observer summed up the situation on his campus as follows:

> The faculty see a conflict between BUILD and research. Promotion and tenure hinge on research. You can't support graduate students by doing (undergraduate) education, and we don't give masters or Ph.D.'s in engineering education. Faculty might welcome (the chance afforded by BUILD for) summer salaries, funding, and publishing opportunities, but if you can't produce graduate students, it will be viewed as less important.

Similarly, an administrator sought to explain the small number of BUILD participants at his university by alluding to institutions he considered more characteristic of the Engineering Education Coalitions:

> If you look at the curriculum innovations sponsored by NSF, most are at places that are not research intensive. Some faculty just don't attach as much rigor or importance to curriculum reform. Faculty really haven't been trained to do this. The coalition has struggled to get faculty to approach their BUILD work as research.

He went on to suggest that on resource-rich campuses like his own, faculty members can afford to be selective about participating in externally-funded projects. "We think of a

significant grant as $100,000 or more. BUILD doesn't have enough money to spread around in big grants."

Faculty Rewards

Although no one seemed to doubt that research was still the dominant element in the academic reward system, there were informants who believed that BUILD had brought about a number of small but welcome improvements at their institutions. One benchmark of BUILD's impact was the value of articles published in engineering education journals, which, according to several interviewees, had previously been about one-third of the comparative worth of publications in engineering research outlets. Thanks to BUILD and the state legislative initiatives on behalf of undergraduate instruction, however, this ratio was said to have risen to approximately one-half or two-thirds. Others, however, suggested that the value of an educational article was calculated not on the basis of a predetermined point scale, but according to its rigor and utility. One person allowed that an article in an engineering education journal could now be viewed as a legitimate scholarly contribution, provided that it was truly "research-oriented." That view was echoed in an administrator's remark that for educational research to pass muster at his institution, "it has to be assessment--finding out what really works" in promoting students' mastery of course content. Although the latter two comments were offered as evidence of BUILD's effectiveness in bringing change to their campuses, their implicit

distinction between useful and frivolous approaches to educational research anticipates a theme that will be developed later in this report.

For some informants, the real test of BUILD's impact was the weight it carried in the promotion and tenure process. Three of those we spoke with had just gone through that process. One, a non-engineer, said of an interdisciplinary course funded by BUILD, "it helped me get promoted. My dean likes it because it injects (my discipline) into engineering and brings in money to our college." Similarly, a newly- tenured associate professor in engineering attributed much of his success to his involvement in BUILD, whose three grants enabled him to develop state-of-the art instructional software for his discipline. In his words, BUILD "started off a whole new area for using multimedia in education. They've seeded this area, and it wouldn't have happened without them." The third interviewee, who had recently been turned down for promotion, was more circumspect. On the one hand, he acknowledged that involvement with BUILD could be beneficial, but attributed his own rejection in part to having spent too much time on the instructional component on his BUILD project and not enough time publishing findings from it and from more traditional engineering research. For him, the lesson was clear: "The bottom line is turn out more papers. I've tried to be balanced, but will put more emphasis on generating articles."

These examples notwithstanding, most interviewees rejected the proposition that BUILD had thus far been a meaningful force for change in the faculty reward systems of their universities; many, however, did hold out the prospect that it might eventually become that. In discussions of how the coalition's ineffectiveness might be remedied,

two themes emerged with particular clarity. The first is that BUILD's weakness as a change agent was attributed not to its focus on undergraduate education per se but to the marginality of its programs. Second, alterations to the faculty reward structure were less likely to bring about instructional reform than vice-versa.

Stating that BUILD was "disconnected with promotion and tenure," one senior faculty member implied that things might be different if and when the coalition brought real reform to engineering education: "People have been teaching engineering for 8000 years. Has anyone in BUILD really come up with anything new?" Rather, he asserted that the emphasis on communications and cooperative learning in some of the new courses was based more on "touchy-feely social science" than on genuine engineering concepts. Others used words like "flakiness" and "peripheral" to describe certain projects. We heard similar views from someone who had tried unsuccessfully to move from a soft-money position with BUILD into a tenure-track faculty appointment. To have any real influence on personnel matters, he said, the coalition would first "have to solve problems that are at the top of the list that the School of Engineering wants to address, such as minority and female retention." Another individual alluded to the importance that engineers attach to concrete facts, noting that BUILD would not get much respect unless it could produce results showing how students benefited from its programs: "Evaluation can help in understanding (program) impact. The key is to keep a program going long enough for something to happen." On the same point, it is worth recalling the suggestions reported in the previous section that publications based on the instructors' classroom

experiences would be respected by peers only as long as they provided concrete evidence of impact on student learning.

Finally, several informants counseled patience, stating that the three or four years of the coalition's existence were not enough time to fundamentally reshape the faculty reward system. One dean predicted that it might take another ten years for this to happen, while another informant called on the coalition to maximize its influence by being responsive to the changing needs of the participating institutions. In her words, BUILD is best understood not in terms of a fixed agenda but as "a set of experiments continually improving."

Discussion

American higher education is often described as an innately conservative institution, slow to respond to demands for cultural or structural change. Speaking specifically of the undergraduate curriculum, Fincher (1986) claimed that universities and colleges try to relieve external pressures by making surface accommodations that leave the status quo substantially intact. Consequently, prescriptions for reform commonly call for a top-to-bottom overhaul of the assumptions by which decisions are made. Fairweather (1996), for example, concluded that "the prospects for institutionalization (of reform) are remote without changing the faculty culture, the rewards which reinforce current norms, and the criteria used to hire faculty in the first place." And as a step toward overhauling the current system of academic rewards, Boyer (1990) has proposed broadening the

prevailing definition of faculty scholarship to include not only research and publication, but teaching and service as well.

The findings that have been reported in this paper cast a somewhat different light on such recommendations. To be sure, informants did perceive that faculty rewards are based more on research than on teaching, and that such change as has occurred has come mostly at the margins of the system. What is more noteworthy, however, is that many of them believed that the surest way that reformers could gain acceptance on their campuses was not by offering incentives but by demonstrating the worth of their programs. Specifically, the suggestions most often offered were that innovations should be shown to be more effective in promoting student learning than existing practices and yet avoid frivolity and novelty by addressing core issues and staying within the recognizable bounds of the discipline. Having established their bona fides, reformers might then be in a position to influence the allocation of faculty rewards in ways that would further strengthen undergraduate teaching.

The extent to which these conclusions might also apply to other reform programs in higher education is uncertain. Recall, for instance, that our interviewees were drawn from the minority of engineering faculty and staff who were sufficiently interested in BUILD's mission as to participate in its programs. Even though we attempted to compensate for this possible pro-reform bias by including a half-dozen informants who had left the coalition (either voluntarily or because their funding was terminated), the overall results still might overstate the potential impact of even the most successful innovations. A second consideration is that the emphasis placed by some interviewees on demonstrating

the effectiveness of coalition projects may reflect the empirical bent of those trained in engineering and thus may not be representative of other scholarly orientations, such as the humanities, fine arts, and some branches of the social sciences. Trow (1970, p. 291), for example, has argued that much of the impetus for higher education reform has come from a simple desire to experiment. In such instances, innovations "justify themselves by their intrinsic qualities almost without regard to their outcomes."

While these concerns may have merit, it is nonetheless instructive to note that the conditions for successful reform that were identified by our sample members correspond closely to a wide range of research and theory on the diffusion of innovation in educational and technical settings. Thus, reviews by Rogers (1994) and Tornatzky and Klein (1982) indicate that the projects most likely to diffuse successfully are those that have a demonstrated advantage over, but are fundamentally compatible with, existing practice. Such a strategy of attending first to the practical details of innovation is sharply at variance with recent recommendations that equate gradualism and compromise with failure (Fairweather, 1996). Yet the visionary tendency displayed by the BUILD coalition was precisely what some of our informants objected to most strongly. In the words of a faculty member with a longstanding commitment to the improvement of engineering education,

> BUILD is a wonderful experiment. It is succeeding in one goal--to invent new courses. New courses will be developed and incremental changes will take place. But its goal is more ambitious than that--to redo entire curricula.

And for that reason, it's almost destined to fail.

Conclusion

In contending that instructional improvements should rise or fall on their own merits, the message delivered by participants in this study is consistent with the growing interest in the intrinsic motives underlying faculty role performance. Research by McKeachie (1997), for example, indicates that faculty are less responsive to external incentives than to the rewards that flow directly from the tasks they perform. Moreover, it is clear that teaching is the primary source of such rewards, as the majority of all higher education faculty, and even a substantial minority of those at research universities, have consistently reported that they prefer the role of teacher to that of researcher (Ladd, 1979; Boyer, 1990; Blackburn and Lawrence, 1995). In the end then, it may be that the most important challenge facing reformers is not to transform the academic reward system but to find ways of capitalizing on faculty members' inherent interest in their instructional role.

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